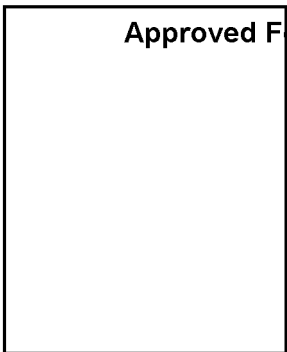


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Approved For Release 2004/11/30 : CIA-RDP78B04770A000700040010-1



January 29, 1969

Dear Paul...

Here are copies of the material I sent to [redacted]
I don't know if they will be of any help to him.

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My original outline was much longer and more detailed. But when I started writing, I found a lot of my notions could be lumped under a few headings. I also discovered as I was writing that there is a hell of a lot we still don't know, that we still have not answered questions that were asked years ago. On the other hand, I feel that [redacted] and Al have made significant progress in their line-scan work.

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I may have told you Joe was here recently and tried out a briefing on the line-scan work with [redacted] Al, and me. It was beautiful. Incidentally, Joe is a fine guy to work with as he was when he was with your company.

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My best regards to you and Judy.

Sincerely,

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[redacted]

Executive Vice President

DNB/gk
Enc.

Declass Review by NGA.

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January 28, 1969

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Dear Hersh:

First an apology. I am sorry I have taken so long to reply to your letter. I know you don't want to hear the excuses.

I made-up a crude outline of how you might structure the symposium and followed that by some comments on each topic in the outline. Where I could, I indicated who might know something about each topic.

I would like very much to attend the symposium; as you know I have some strong opinions about research on photointerpretation. Also I would enjoy trying to help you in organizing the affair so don't hesitate to ask for my help if you think I can.

I have enclosed a copy of the note I sent to [redacted] I am not sure it was relevant to his request nor am I sure it is relevant to your symposium. On the other hand, you might consider a paper or discussion on "research requirements."

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Best regards,

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[redacted]
Executive Vice President

DNB/mo
Encl.

SYMPOSIUM COMMENTS

(Outline)

I. THE PHOTOINTERPRETER

- A. SELECTION
- B. TRAINING
- C. PERFORMANCE MEASUREMENT

II. PHOTOGRAPHIC STIMULUS MATERIALS

- A. IMAGE QUALITY ASSESSMENT
- B. EFFECTS OF QUALITY ON PI PERFORMANCE
- C. EFFECTS OF OTHER TYPES OF FILM ON PHOTOINTERPRETATION

III. OTHER SENSORS

IV. REAL-TIME INTERPRETATION

V. LINE-SCAN IMAGERY

SYMPOSIUM COMMENTS

I. THE PHOTOINTERPRETER

A. Selection.

To my knowledge, which in this area is certainly limited, little has come of the selection research that has been done, probably because of the difficulty in developing valid performance criteria for predictor validation. I don't think the Army group [] and crew) has had much success. The work at [] was nonsense. [] School of Forestry, had optimistic research plans that didn't lead to much. [] talked about *Aids for the selection and training of photo interpreters* at the annual meeting of the Society of Photogrammetric Engineering in March 1964, but he didn't present any research data.

Perhaps you or the people at [] have had or know of people who have had success in validating selection techniques. The criterion problem--as I see it--has diminished my interest in selection research at this time. (One time I told Paul's group to get smart people who can see.)

B. Training.

To my knowledge very little research has been done on the training of PIs. I have an abstract of a study

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by [] in front of me and he concluded that two performance tests "judged to be relevant to photo interpretation...did not reveal a significant indication of increase in perceptual skills as a result of training." I can't evaluate the conclusion because I don't have the article and I don't have a complete reference. I can't believe that learning isn't involved in the recognition skills required of the PI, at least the type of PI work done in Paul's building. [] on our staff found learning from trial to trial in an object-identification perceptual task. I question the tests and criteria used in the [] work.

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The point is, though, we don't know how to train PIs even in something as fundamental as target recognition. And to my knowledge no one is doing any research on the topic. Consequently, it seems to me that what might most appropriately be discussed at your symposium is:

"What training research should we be doing?"

"What training questions should be answered concerning the interpretation of photography (including color) and other types of sensors?"

C. Performance Measurement.

Research on the selection, training, and assignment of PIs--as I mentioned earlier--obviously depends on having valid performance criteria. Furthermore, the results of

much of the research on photointerpretation are of limited usefulness or entirely useless because the performance measures were irrelevant or invalid. Consequently an appropriate and interesting question would be: "Have any significant advances been made in methods of measuring PI performance?" The [] group might have something interesting to say on performance measurement.

II. PHOTOGRAPHIC STIMULUS MATERIALS

A. Image Quality Assessment.

I feel that image quality assessment is an important topic. The [] committee report on "Image Quality Evaluation" was published in 1965 and may be behind the times now, but it contained important information that still might be worth giving wider dissemination.

Many excellent people have worked in the field, but I would be inclined to recommend [] Director of Research [] if I were to choose one person to give a paper. He has looked at all aspects of the problem: physical measurements, e.g., MTFs, subjective judgments, and performance tests.

[] who used to be with [] but now is back in England (his original home) would be another excellent choice. Both [] are physical scientists with strong interests in psychophysics.

B. Effects of Quality on PI Performance.

As far as interpretation and analysis is concerned, our work is probably the most advanced, at least in terms of the resolutions studied. Unfortunately, I don't think we could get permission to give a paper or talk about it, and I don't know who else is working in the field.

The study we did with [] on the effects of quality on measurement accuracy is to my knowledge the most comprehensive study of its kind. If you recall we gave you a copy of the report when you were here. As it stands, the report is much too long and complicated for a paper, but I think it could be boiled down to a very interesting one. I would be delighted to give it assuming I could boon-doggle my way to Europe.

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C. Effects of Other Types of Film on Photointerpretation.

I have color and camouflage detection films in mind. I know almost nothing about the topic and don't know who does. Perhaps the people at [] could give you some ideas.

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III. OTHER SENSORS

I have only a simple question in mind: What is infrared and side-looking-radar imagery good for? Again I know almost nothing.

IV. REAL-TIME INTERPRETATION

Real-time interpretation is probably inevitable, real-time in the vehicle and on the ground. I don't know of

any research that has been done on possible interpreter problems other than our line-scan image research and "real-time" does not necessarily imply line-scan imagery. Assuming no one has a head-start and some data, I would tentatively suggest a discussion of possible problems and research needs.

V. *LINE-SCAN IMAGERY*

Many future reconnaissance systems will likely involve electronic transmission of imagery and subsequent display on TV-like displays. For this reason, [REDACTED]

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[REDACTED] have started a research effort designed to determine what the display requirements are for the interpretation of line-scan imagery. A brief review of the literature indicated that little has been done in the field in spite of our feeling of its importance.

So far Frank and Al have completed three studies. In all of them, they have used models of targets--tanks and trucks and the like--and simulated, positive transparencies made on the device [REDACTED] designed. In the first study, they investigated target classification and identification as a function of the number of scans per scene object and the angle of view. In the second, they investigated identification accuracy as a function of the number of scans per scene object and the number of gray levels. In the third, they investigated identification accuracy

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as a function of the numbers of scans per scene object and the Gaussian signal-to-noise ratio.

Other studies are currently being planned: A study like the third just described except that the noise will be signal dependent; a study of classification accuracy as a function of the number a scans and scale; and a study of classification accuracy as a function of the number of scans, scale (or both, depending on earlier results) and contrast.

Again, assuming I can boon-doggle my way to Europe, I would be happy to report the results of this research. I don't know of any similar work, and I think the results are interesting.

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TO:

FROM:

DATE: March 5, 1968

SUBJECT: Proposed Resolutions for the ASP Meeting in
Washington in March

Thank you for including me among your correspondents regarding the proposed resolutions.

Let me begin with some qualifying statements. I am a member of the American Society of Photogrammetry, but I have not been an active participant. My knowledge of the activities of the International Society of Photogrammetry is very limited. I don't know what the relation is between ASP and ISP, and I don't know what ISP's charter is. Consequently, my comments here may be entirely irrelevant.

As you might expect, my comments concern the PI primarily. Perhaps they can best be expressed as answers to two questions.

1. *What are the methodological requirements for research on PI performance?* As I see it, there are three major requirements.

First, the photographic stimulus conditions must be thoroughly and accurately defined in physical terms, the terms that are used by photographic scientists and engineers, for example, modulation transfer functions. If they are not, designers can not, and will not, use the results of the research in their work. This first requirement seems obvious, yet much of the research done on PI performance is worthless. It has not been accepted by physical scientists and engineers simply because the stimulus conditions--the photographs--were not adequately specified.

Thorough and accurate stimulus specification is particularly crucial in studies of mensuration accuracy as a function of other variables, for example, ground resolution, type of machines, magnification, illumination, reticle, and so on. The researcher *has* to know the geometry

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of the photograph, the magnitude of any distortion introduced through processing, as well as the usual physical parameters like MTF.

The second requirement is "ground truth." The researcher has to know what is *in fact* in the image. This requirement sounds obvious, too. Nevertheless, many studies have been done in which "ground truth" was established on the basis of "expert" judgments of what could be seen in the same photographs used for the research.

The third requirement is this, the task the PI is asked to perform must be meaningfully related to his job. If, for example, the task is target recognition, targets representative of the real world should be used. In some studies, Landolt rings have been used as targets; yet it has been shown that visual acuity measures obtained with Landolt rings are only very weakly related to pattern recognition performance.

In many studies, the PI's subjects have been asked to perform trivial tasks that bear little relation to what, in my mind, is "interpretation," the kind of detailed work done by the professionals in your group. The reason for this is probably the fact that it is difficult to design a valid measure of interpretation performance.

For some studies, psychophysical judgments are appropriate. We have learned in our work that experienced PIs and scientists make very reliable psychophysical judgments in assessing photography.

2. *What are some of the questions that should be answered through experimental research?*
I will just list some of the questions I think should be answered for your company.

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Page Three

- a. What is the utility of color for different types of PI tasks? What resolution in color is required for different tasks? Is less resolution required with color than with black and white? Under what circumstances? What mensuration accuracy can be expected from color at different resolutions?
- b. What are the requirements for precision in different mensuration tasks? What resolutions are required for such precision? What are the sources of mensuration inaccuracy?
- c. What problems will be encountered with sampled images, for example, line scan or digitized images? What are the implications of sampled images for the design of exploitation equipment?
- d. What is the utility of different types of sensors for different PI tasks? (Perhaps this question has been partially answered.)

My comments are brief and intended only to give you starting points for your discussion. Please call me if I can be of assistance.

Best regards,

DNB/gk